

Details for Mechanically Vented Crawlspace - Code Notes

[2000 IRC, 2003 IRC, 2006 IRC, 2003 IECC, 2006 IECC, 2009 IECC]

Codes allow crawlspaces with mechanical ventilation instead of crawlspaces with passive vents to the outdoors. However, code officials and builders are often uncertain about the design details.

Traditional crawlspace designs include passive foundations # wall vents that are supposed to let moisture and contaminants escape outside. Yet field research shows that wall vents may make moisture problems worse. Replacing crawlspace vents with an exhaust fan and drawing house air in to condition the crawlspace reduces moisture problems and can increase energy efficiency.

The International Residential Code (IRC) specifically allows crawlspace designs with an exhaust ventilation system instead of fixed ventilation openings through the foundation walls. To comply, a mechanically vented crawlspace design must have a continuously sealed, vapor-retarding ground cover, have no fixed ventilation openings to the outdoors, and be supplied with a continuously operating exhaust fan.

Sizing the fan: Size to the code minimum. Eliminate the foundation vents when continuously operated mechanical ventilation is provided at a rate of 1.0 cfm for each 50 sq. ft. of under-floor space (e.g., 20 cfm per 1000 sq. ft.) (IRC 2000/2003 Section R408.2, Exception 4; IRC 2006, Section R408.3).

Type of fan: The code does not specify details about fans used in crawlspaces. One possibility is to follow the Colorado amendments to the IRC. Colorado requires a fan rated for 44,000 hours (five years) of continuous operation with flex connections, or other installation detailing to reduce vibration and noise associated with the fan. The fan must be connected to a trouble light or an alarm to signal occupants when the fan fails.

Supply air for the exhaust fan: The IRC requires an air pathway to the common area (transfer grille), but does not specify size and location. The Colorado amendments to the IRC recommend transfer-air openings, one per 250 sq. ft. of crawlspace floor area, are installed in the decking between the crawlspace and conditioned rooms above. A continuously operating exhaust fan pulls house air down through these openings. Airflow through the transfer openings is restricted (e.g., through a capped boot that has holes drilled in the cap) as shown in Table 1.

Amount of air required	Minimum hole size	Maximum hole size
0-10 CFM	1.5 sq in.	2.4 sq in.
11-15 CFM	2.4 sq in.	3.6 sq in.
16-20 CFM	3.6 sq in.	4.4 sq in.

Code Compliant Construction Details

Pressure balance: The crawlspace exhaust fan, typically 30-60 cfm, will exert slight negative pressure on the house above. The resulting negative pressure will roughly equal that from a bathroom fan, but it will be considerably less than the pressure generated by dryers and kitchen exhaust fans. The following is the recommended design specification: when all exhaust appliances and any forced-air HVAC system operate simultaneously, any zone with an atmospherically vented gas appliance should experience less than 3 pascals of negative pressure.

Plan Review

1. Removal of debris: clean the under-floor grade of all construction materials, vegetation, and (non-soil) organic material (2006 and 2009 IRC R408.5).
2. Crawlspace insulation: install in accordance with the IECC or IRC specifications (2006 IECC 402.2.8, 2009 IECC 402.2.9 or 2006 IRC N1102.2.8, 2009 IRC N1102.2.9).

3. Ground cover: apply a continuous vapor retarder that is a Class I vapor retarder with less than 1.0 permeance (e.g., <http://resourcecenter.pnl.gov/cocoon/morf/ResourceCenter>)



sheet polyethylene). All joints in the vapor retarder need to be overlapped by six inches, and sealed or taped. The vapor retarder also must extend up the foundation wall by at least six inches, and attached to the stem wall. The vapor retarder should also be attached to all piers and other penetrations to be an effective ground cover.

4. Fan (when using Section R408.3 of 2006 or 2009 IRC): size to provide a minimum of 1 cfm per 50 sq. ft. of under-floor space.
5. Supply-air pathways: look for pathways allowing house air to be drawn, under slight negative pressure, into the crawlspace (e.g., one transfer-air grille per 250 sq. ft. of crawlspace floor area). Calculations should specify transfer air sizing.

Code Citations*

IRC 2006 and 2009, Section 408.3 Unvented crawlspace

Ventilation openings in under-floor spaces specified in Sections R408.1 and R408.2 shall not be required where:

1. Continuously operated mechanical exhaust ventilation at a rate equal to 1.0 cfm (0.47 L/s) for each 50 ft² (4.7 m²) of crawlspace floor area, including an air pathway to the common area, and perimeter walls insulated in accordance with Section N1102.2.8.
2. Conditioned air supply sized to deliver at a rate equal to 1.0 cfm (0.47 L/s) for each 50 ft² (4.7 m²) of under-floor area including a return air pathway to the common area, and perimeter walls insulated in accordance with Section N1102.2.8.

IECC 2006, Section 402.2.8 and IECC 2009, Section 402.2.9 Crawlspace walls

As an alternative to insulating floors over crawlspaces, crawlspace walls shall be permitted to be insulated when the crawlspace is not vented to the outside [excerpt].

For More Information

1. The Case for Conditioned, Unvented Crawlspaces by Peter Yost and Ann Edminster, Building Safety Journal, May 2003
2. Recommended Moisture Control Amendments to the IRC from the Colorado ICC Chapter (Sept 2003 draft); and Guidelines for Design and Construction of New Homes with Below-Grade Underfloor Spaces from the Moisture Management Task Force, September 2003 draft.

References

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